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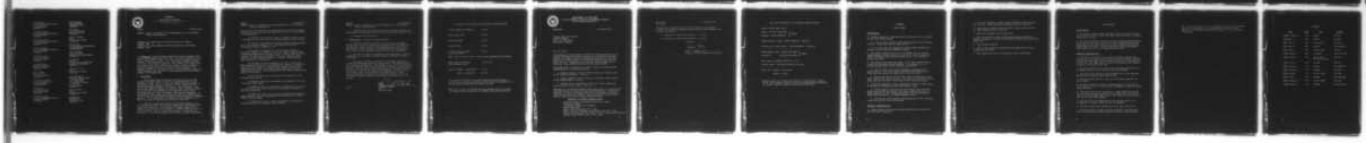

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REPORT OF
COLD CLIMATE CLOTHING AND SURVIVAL EQUIPMENT WORKSHOP

USAAAVS
U.S. ARMY AGENCY
FOR AVIATION SAFETY

U.S. ARMY AEROMEDICAL
RESEARCH LABORATORY

REPORT OF
COLD CLIMATE CLOTHING AND SURVIVAL EQUIPMENT WORKSHOP

jointly sponsored by
U.S. ARMY AGENCY FOR AVIATION SAFETY
and
U.S. ARMY AEROMEDICAL RESEARCH LABORATORY
Fort Rucker, Alabama

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Report of Cold Climate Clothing and Survival Equipment Workshop held 24-27 September 1974 at Fort Rucker, Alabama.

Recognition of needs for improvement in aviation cold climate equipment prompted the U.S. Army Agency for Aviation Safety and the U.S. Army Aeromedical Research Laboratory to jointly sponsor a workshop to identify shortcomings in the Army's cold climate clothing and survival equipment and recommend solutions. The workshop focused on specific problems encountered (cont'd)

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by Army aviation in Alaska. However, requirements of aviation units operating in other cold climates were also addressed.

The workshop resulted in identification of deficiencies in cold climate flight clothing, cold climate survival kits, individual vest-type survival kits, cold climate training, emergency locator transmitters, and management of life support equipment.

Attendees were representatives of concerned agencies and commands. They recommended actions to expedite short-term improvement of U.S. Army Alaska's cold climate equipment and to effect long-term overall improvement in Army aviation's cold climate life support and survival equipment and management.

Also included is a report on the Workshop to Draft Requirements for a Cold Weather Flight Clothing System held at Fort Rucker 9-13 December 1974.

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REPORT OF
COLD CLIMATE CLOTHING
AND SURVIVAL EQUIPMENT WORKSHOP

INTRODUCTION

Wide ranges of geographic, atmospheric, and temperature environments are encountered daily by flight crews operating in zones VI and VII. In Alaska, temperatures range from +80 degrees F. in the summer to −60 degrees F. in the winter with winds up to 100 mph. Flight crews in these areas are continuously concerned with remaining warm during operations and maintaining maximum probability of survival in the event of an emergency. The compromise between equipment required for flight and that required for survival is a difficult one. Cold weather flight clothing must provide adequate warmth, comfort, and mobility for the aircrew to perform effectively in the cockpit, yet be capable of helping sustain an aircrewman in a survival situation. These goals are antagonistic in that an increase in one may bring a decrease in another. For example, wearing heavy mittens would greatly increase hand warmth and comfort; however, flying the aircraft would be more difficult. Compromises must also be made with cold weather survival equipment. The equipment must be lightweight and take up as little room as possible. Weight and space are important aspects from a logistics and escape standpoint.

Crew confidence in survival equipment is an important aspect that is often overlooked. In an actual emergency, crew attitude can mean the difference between survival and nonsurvival. An individual who lacks confidence in his equipment often fails to learn how best to use it and therefore is poorly prepared for a survival situation.

Flying in Alaska is quite different from flying in temperate environments. Rotary wing aircraft fly with skis, even in summer, due to the permafrost condition. This is a condition where the ground is permanently frozen and only the top few inches thaw in warmer weather. Deep frozen layers prevent the upper layers from draining, resulting in a top layer of slush. Additionally, there are few roads, houses, and settlements to use for reference, and limited navigational aids.

A summer flight might begin in a warm, lush green area and end in rocky, snow-covered mountains with temperatures well below zero. Mission performance and survival in these conditions require special precautionary measures in training and equipment.

SUMMARY OF CONFERENCE RECOMMENDATIONS

Operations and survival in cold regions of the world require adequate specialized equipment and a thorough knowledge of how to use it. The workshop concluded that present cold climate clothing and survival equipment fails to adequately meet needs of Army aircrews.

The following changes were recommended:

1. Cold Climate Clothing

a. Develop a standard cold weather ensemble adequate for use by Army aircrews operating in zones V, VI, and VII.

b. Investigate feasibility of using the Canadian cold weather system until development of a standard ensemble can be completed.

c. Authorize and provide funds for local modification of present parka to include installation of zipper in the hood and replacement of buttons with velcro fasteners.

2. Cold Climate Survival Kit, Individual

a. Replace present sleeping bag with a bag having better insulation value.

b. Replace present snare wire with corrosion-resisting steel wire.

c. Add gill net.

d. Replace hard pack metal cans with soft plastic packets.

e. Add Distress Marker Light (Strobe) SDU-5E.

f. Delete poncho.

g. Add combat casualty blanket (space blanket).

h. Add Signal Kit, Personnel Distress (pen gun flare).

i. Add two smoke and illumination devices to kit and equip all smoke devices with flotation collars.

j. Add multipurpose "Skachet" which serves as hatchet, hammer, skinning knife, etc.

k. Increase quantity of compressed trioxane fuel from three to six.

l. Add 50 feet of seven-strand nylon cord to each kit.

m. Reduce number of candles from four to two.

n. Add one package of high visibility tissue (colored "Kleenex" type).

o. Delete snow shovel.

p. Authorize modification of fry pan for use as a combination fry pan and snow shovel.

q. Delete mosquito head net.

3. Survival Kit, Individual, Vest Type, SRU-21/P and OV-1 Type

a. Improve battery for strobe light (Light, Marker, Distress).

b. Add combat casualty blanket (space blanket).

c. Add one package of high visibility tissue (colored "Kleenex" type).

d. Expedite development of battery for AN/PRC-90 for extreme cold climates.

4. Cold Climate Survival Training. Army personnel presently attend an Air Force cold weather school which uses only Air Force equipment. It was recommended that efforts be made to insure use of Army equipment.

5. Emergency Locator Transmitter (ELT). Location of downed aircraft in Alaska has proved to be difficult. The primary ELT used by civilian aircraft operates on VHF, while the military survival radio operates on UHF. It was recommended that USARAL be authorized to purchase and install VHF ELT's to enhance the probability of location of downed aircraft.

6. Life Support Equipment Management. Participants concluded that deficiencies reported at the workshop could have been avoided had an effective life support equipment program been in operation. It was recommended that increased effort be made to implement an Army life support equipment program.

SPECIFIC DEFICIENCIES AND PROPOSED ACTION

The Cold Climate Clothing and Survival Equipment Workshop focused on specific problems encountered by USARAL with emphasis on interim improvements for their immediate use. Permanent improvements were suggested, and, upon completion of testing and evaluation, may be included in the life support and survival system.

Attendees (Appendix A) identified several areas in which deficiencies were noted:

- Cold Climate Flight Clothing
- Cold Climate Survival Kit
- Survival Kit, Individual, Vest Type
- Cold Climate Training
- Emergency Locator Transmitter
- Life Support Equipment Management

1. Cold Climate Flight Clothing. The Army, at this time, does not have a standard cold weather ensemble for aircrews operating in extremely cold environments. This lack of a standard ensemble is evidenced by numerous supplements to AR 95-1. These supplements allow substitution of items to meet uniform requirements. This is not to imply that all supplements are bad, for some substitution must be made to effectively perform required tasks with some level of comfort and safety. As a result, ensembles that emerge from this practice are a mix of items from a variety of sources. To simplify procurement, cut costs, and provide safety, a standard ensemble for extremely cold weather is required. This ensemble is meant to fill the need of aircrews operating in temperatures from -20° to -70° F. USARAL has identified the following items of cold climate clothing as unsatisfactory:

a. Footwear. The vapor barrier boots, cold weather, men's rubber, white, have proven unsatisfactory because the toes are too large to fit into recessed access panels on aircraft. This presents a safety hazard, especially during preflight inspections. Additionally, pilots report that the size and thickness of the soles prevent proper control touch (sense of feel for operating pedals).

Most personnel are presently using Air Force mukluks; however, these are unsatisfactory for they do not provide sufficient warmth during severe cold, and are not fire retardant, waterproof, or durable. They also tend to freeze after becoming wet, and crack with use. The U.S. Air Force has investigated this problem and determined that storage, which USARAL thought was the problem, was not the cause of cracking. The mukluk has since been modified and the current issue should be less susceptible to cracking. Until these modified mukluks reach users, a treatment of spray-on water repellant might reduce water absorption and cracking.

The Canadian Liaison Officer at Fort Rucker, Major J. R. Pugh, exhibited the Canadian cold weather footwear system: a mukluk boot, duffle socks, and insoles. Overall height of the muk-

luk ranges from 13½ inches to 16½ inches, depending on size. The winter flying overboot is also of mukluk design, similar to the cold weather footwear system except that height and sole area are reduced to be compatible with flight suits and aircraft controls. However, this boot offers little ankle support, and would not be suitable for long-distance walking.

The conferees recommended that modified U.S. Air Force mukluks be promptly issued to users and the Canadian cold weather footwear system be evaluated for possible use until an Army cold weather ensemble can be developed.

b. Undergarments. Army aircrews have expressed dissatisfaction with present 50% cotton/50% wool undergarments because of body irritation. A recommendation was made to authorize USARAL use of U.S. Navy waffle knit underclothes, drawers and undershirt, extreme cold weather, cotton (reference NAVAIR 00-35QH-Z) as an interim replacement. It was also recommended that the USAF CWU-9/P garment plus inner liner be evaluated for Army use.

c. Outer Garments:

(1) Coveralls, Flying, Sage Green (CWU-1/P). Although no specific deficiency was noted with this coverall, it is often used as an outer garment over the two-piece Nomex flight suit. This is an Air Force item and has been classified as standard "B" and no further procurements will be made. It was recommended that these items be used until stocks are depleted, and that the Canadian two-piece cold weather flight suit be evaluated for use until an Army cold weather ensemble can be formed. The Canadian cold weather flight suit is intended to be worn with several layers of inner garments. This layered configuration gives required fire protection. The trousers extend above the waist to prevent exposure of the back to cold air if the jacket should ride up while the wearer is sitting.

(2) Parka. Deficiencies in the present U.S. Air Force parka were noted. The hood bunches behind the neck and presses against the flight helmet, making it difficult to hold the head erect. Also, the hood interferes with the shoulder harness. The large buttons are difficult to manipulate without removing the mittens. This increases exposure to cold injury.

It was recommended that USARAL be given permission and funds to split the hood and install zippers to prevent the hood from bunching and to replace the buttons with velcro fasteners. USAARL has requested from the Canadian government one Jacket, Mens, Flying, Cold Weather, and one Trouser, Mens, Flying, Cold Weather, for evaluation and possible adoption by the Army.

(3) Handwear. Present Nomex gloves fail to provide adequate hand protection from cold weather. It was recommended that funds be approved and procurement made of a heavyweight fire-resistant glove for USARAL aircrewmembers and that evaluation of this and other cold weather gloves be made for possible worldwide distribution.

2. Cold Climate Survival Kit, Individual, NSN 1680-00-973-1862 and OV-1 NSN 1680-00-782-3003. Major J. P. Eddy and Captain J. E. Rieder of USARAL described deficiencies found with this kit and made recommendations for changes. These changes were discussed by the conference in terms of potential increases in survival benefits and crew morale. Deficiencies discussed were:

a. Sleeping Bag. The present sleeping bag, SRU-15/P, has been judged inadequate to maintain body temperature at a safe level in extremely cold environments. The criterion that this survival sleeping bag does not meet is allowing 3 hours of uninterrupted sleep in cold weather. In addition, there is a bolt through the middle of the bag and container to reduce the size. This bolt punctures the bag many times. These holes do not greatly alter the heat retaining ability of the bag, but may cause considerable unnecessary concern among crewmen downed in actual emergencies. Additionally, the bolt mechanism cannot be opened while wearing heavy gloves. Removal of gloves to open the bolt mechanism creates unnecessary exposure to frostbite.

The U.S. Army's Natick Laboratory is evaluating samples of six commercially available sleeping bags, one or more of which will be selected to be vacuum packed and recommended as a temporary item for use in cold climate survival kits. The U.S. Army Materiel Command (AMC) is investigating the feasibility of procuring the A/P-22S-5, USAF walk-around sleeping bag, as a permanent item for the kit. It is estimated that two years production lead time would be required following a decision to acquire the walk-around sleeping bag.

b. Snare Wire. The brass snare wire now contained in this kit becomes brittle and tends to break in extreme cold. The following was recommended as a replacement: steel corrosion-resistant wire of .020 inch diameter. This wire (NSN 9505-00-596-5101) is available in 5-pound coils in the supply system.

c. Fishing Equipment. Although the present fishing kit is useful, its use is limited in arctic areas due to lack of open water. It was recommended that the present fishing kit be augmented with a gill net, NSN 4240-00-300-2138. This addition would enhance the ability of a downed aviator to catch fish with little increase in cost, size, or weight of the kit. The method of deployment of the gill net also increases the chance for survival. The net can be set through a hole in the ice and left there while the survivor returns to the warmth of his shelter. Later, he can return and retrieve his net and catch without having to spend extended periods exposed to the cold.

d. Food Packets. The hard pack metal cans presently contained in the kit have been identified as being difficult to open. Under normal survival situations it requires removal of arctic mittens and is next to impossible to open should hand injuries occur. Plastic soft packets are recommended as replacements for the cans. Food in the soft packets is the same as in the cans.

e. Distress Markers. For arctic survival situations, present signaling devices were found to be inadequate. The smoke devices sink in snow, severely limiting visible smoke output. The flares fired from a pen gun have too short a burning life (90 seconds for a full burn). To increase signaling capabilities, the following changes are proposed:

(1) Add to cold climate survival kits, individual and OV-1, one distress marker light, SDU-5/E, equipped with battery and shield. This suggestion is made recognizing that the current battery is not adequate in extreme cold. However, functional use of the device can be extended by keeping it warm with body heat.

(2) Add Signal Kit, Personnel Distress, Foliage Penetrating, Red Model No. 201, NSN 1370-00-490-7362. Also, it was recommended that seven white flares be added to the normal complement of flares issued in the kit. This would increase the number of flares available for use at night when smoke devices are not a practical means of signaling.

(3) Add two additional smoke grenades to the cold climate survival kit and recommend that smoke and illumination devices be equipped with flotation collars to prevent them from sinking into the snow.

f. Poncho. Because of its limited use in a cold climate survival situation and because it requires a great deal of space in the kit, it was recommended that the poncho be replaced by the Blanket, combat casualty, 56" x 96", NSN 7210-00-935-6667 (Space Blanket). This blanket is light, requires less storage space, and provides excellent ground cover. The color of one side is international orange for use as a signaling panel. Instruction must be given in the use of this item. Improper use of the space blanket can be extremely hazardous. Insulation between the body and the blanket is absolutely necessary. If this item is placed next to the skin it will act as a radiator, dissipating rather than retaining heat.

g. Compressed Trioxane Fuel. The kit now contains three of these items, which was deemed insufficient. It was recommended that the kit contain six.

h. Candles. Due to their limited use, it was suggested that the number of candles be reduced from four to two.

i. Shovel, Snow, Teflon Coated. This shovel has proven to be ineffective in loose powder snow, such as found in Alaska. The powder snow tends to slide off the shovel due to its teflon surface and the lack of sufficient retaining edges. Due to these deficiencies, it was recommended that the item be deleted from the kit.

j. Fry Pan. A recommendation was made to modify the fry pan so it could be used as a snow shovel in addition to its other uses. It was suggested that one of the short sides be cut down so that only a small lip remains. This forms a three-sided box that will contain powder snow and still be able to hold water when tilted away from the modified side.

k. "Skachet." This is a new multipurpose item, now used in Alaska by trappers and bush pilots, which would serve as a hatchet, hammer, skinning knife, etc. It was recommended that one be added to each kit.

l. Cord, Nylon, Natural Color, 550 pounds, NSN 4020-00-240-2146. This is a seven-strand cord that can be used for many purposes, e.g., lashing, snare tiedowns, clotheslines, etc. It was recommended that 50 feet of this cord be included in each kit. Strands used individually increase usable length to 350 feet.

m. Tissue, High Visibility. A recommendation was made to include in each kit a quantity of brightly colored tissues. About 20-25 of these "Kleenex" type tissues should be used as trail markers, fire starters, etc.

n. Head, Net, Mosquito, M-1944. Since mosquitoes are not a significant problem during winter months, it was recommended that this item be deleted.

3. **Survival Kit, Individual, Vest Type, SRU-21/P and OV-1 Aircraft Type.** During summer months, rotary wing aviators wear the individual vest type survival kit. OV-1 crewmembers wear this vest all year. In several areas, such as Northern Europe and Alaska, summer missions often require flights over areas where arctic conditions still prevail. To improve utility of the survival vest, the following additions and improvements were recommended:

a. Light, Marker, Distress (Strobe Light) SDU-5/E. Usefulness of this device is limited due to diminished battery operation in very cold temperatures. It was recommended that an improved battery be made available at the earliest possible date.

b. Blanket, Combat Casualty, 56" x 96", NSN 7210-00-935-6667 (Space Blanket). Addition of this multipurpose item would provide ground cover and wind and rain protection, and serve as an alternate signaling device. It was recommended that one of these be added to each vest.

c. Tissue, High Visibility (Colored "Kleenex" type). It was recommended that one small package (20-25 pieces) of brightly colored tissue for use as trail markers, fire starters, etc., be added to each vest.

d. Radio Set, AN/PRC-90 (survival radio). This radio is designed to operate at temperatures of −22° F. to +131° F. However, test data indicate that reduced efficiency can be expected at the lower operating temperatures. The USAF, Life Support Systems Program Office, is aware of the reduced operating efficiency and is currently attempting to develop another battery or a means to improve the low temperature operating efficiency of this battery. It was recommended that every effort be made to expedite development and procurement.

4. ***Cold Climate Survival Training.*** Presently, Army personnel attend a cold climate survival school conducted by the USAF using USAF equipment. Army personnel who graduate from this school have a good background in the basics of cold climate survival using Air Force equipment. Unfortunately, these graduates may be unfamiliar with the Army survival kit or how to use it. Failure to teach Army doctrine using Army cold climate survival kits precludes the Army receiving feedback essential to a Life Support Equipment (LSE) program. Lack of feedback prevents LSE personnel from determining if inadequacies are due to training or equipment deficiencies. This also places the Army aircrewman at a disadvantage for he must use equipment in an actual emergency on which he has received little or no training. Army National Guard units appear to have considerable difficulty in this area. These units find it difficult to obtain funds and quotas for the Air Force school.

It was recommended that the Army establish its own cold climate survival school or augment the Air Force school so that it could accept more people and give training using standard Army equipment.

5. **Emergency Locator Transmitter (ELT).** Flying in Alaska presents some unique problems. These include remote operating areas, cold weather, and few roads and houses to use for navigation reference. If an emergency arose, it would likely be in a remote area. At any time of year an aircrew may be forced down in areas of extreme cold. Because survival in extremely cold environments is very difficult, it is important to locate and rescue a downed aircrew quickly. To facilitate location, each aircraft should be equipped with an ELT. The survival radio provided by the U.S. Army, the AN/PRC-90, operates on UHF. Civilian ELT's used by the numerous civilian pilots in Alaska operate on VHF. To increase the probability of rescue, it was recommended that USARAL be given approval and funds for acquiring off-the-shelf VHF ELT's capable of operating in extremely cold climates. An Army aircraft equipped with one of the VHF ELT's would

stand a much greater chance of being located and in a shorter time than an aircraft not so equipped.

6. Life Support Equipment Management. It was concluded that deficiencies brought out in the preceding paragraphs could have been avoided if an effective life support equipment program had been in operation. A systematic approach to problems associated with life support equipment has been lacking. Consequently, needs of the Army and the individual crewman have not been fully met. It must be realized that personnel LSE programs must be developed concurrently with aircraft systems. The practice of USARAL AH-1G crewmembers stowing survival kits in the aircraft's ammunition bay is an example of mismatched personnel life support and aircraft development. This and other similar problems point to the need for an increased effort in life support management. Individual stopgap measures are not the best solution and all too often result in duplication of effort and unnecessary expenditures. Life support has long been recognized by the Air Force as an area important enough to require a specialty field. As new Army aircraft gain in sophistication, planning for the future can easily save lives as well as dollars.

It was recommended that the Army increase efforts to provide for aircrew safety throughout the life cycle of the aircraft. The importance of life support suggests that thought be given to augmenting an existing MOS to include life support as a function within that MOS.

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APPENDIX B

DEPARTMENT OF THE ARMY
UNITED STATES ARMY AGENCY FOR AVIATION SAFETY
FORT RUCKER, ALABAMA 36360

IGAR-TA 9 January 1975

SUBJECT: Report of Workshop to Draft Requirements for a Cold Weather Flight Clothing System

Commander, U.S. Army Agency for Aviation Safety, Fort Rucker, Alabama 36360
Commander, U.S. Army Aeromedical Research Laboratory, Fort Rucker, Alabama 36360

1. Background. The Cold Climate Clothing and Survival Equipment Workshop of 24-27 September 1974 found that: *"A standard ensemble for cold climate flying does not exist. As a consequence, commanders and crewmembers, to meet requirements of U.S. Army, Alaska (USARAL) Supplement 1 to AR 95-1, are required to improvise. The ensembles that emerge from this practice are a mix of items selected from a variety of sources."* Since this problem was beyond the scope and time available of the September workshop, it was agreed to call a second workshop to deal with flight clothing. This report is of that workshop held at Fort Rucker, Alabama, 9-13 December 1974.

2. Proceedings.

a. Much time was spent discussing the implications of the draft regulation AR 1000-1, Basic Policies for System Acquisition by the Department of Army. MAJ R. A. Young, HQ, TRADOC, briefed attendees on the changes proposed and gave guidance as to the limitations of the various requirement documents. As a result of the discussion, it was agreed that a Required Operational Capability (ROC), originally planned to be produced by this workshop, was not appropriate and a Letter Requirement (LR) or Letter of Agreement (LOA) was more appropriate. It was agreed that CDA, Alaska (AK) and Natick Laboratories (NLABS) would jointly prepare the requirement document with the assistance of attending agencies. It was agreed that a requirement document, whether it be a LOA or LR, should be completed not later than 1 July 1975.

b. Types of clothing Army aviators are presently wearing in cold and extreme cold climate and their shortcomings were discussed (for clo values see inclosure 1). The Canadian cold climate flight clothing ensemble was discussed with the viewpoint of possible adoption of any or all of its parts. (For clo values see inclosure 2 and for cost see inclosure 3.) Discussions revealed the necessity to further investigate

the protective characteristics and compatibility of the US and Canadian systems with Army rotary wing and fixed wing aircraft. For this purpose, it was agreed that:

(1) CDA (AK) would forward a request to NLABS to initiate action to determine the clo value of Air Force mukluks issued to Army aviators.

(2) CDA (AK) would furnish cold weather flight clothing presently used in the command to NLABS for U.S. Army Research Institute of Environmental Medicine (ARIEM) for test.

(3) CDA (AK) will furnish U.S. Army Aeromedical Research Laboratory (USAARL) one ensemble of their cold weather flight clothing to determine compatibility with Army aircraft. Special emphasis will be placed on the restriction of movement of the crew, especially those required to handle inflight emergencies. Synthetic flight trainers may be employed for this purpose.

(4) CDA (AK) will make arrangements for the U.S. Army Arctic Medical Research Laboratory to take temperature readings of cockpits of Army rotary wing aircraft to determine time required to bring cabin temperature up to +40°F after doors have been opened as in combat or combat support missions. These measurements will probably be made during operation "Jack Frost."

(5) CDA (AK) will obtain and evaluate the suitability of the Canadian flight ensemble.

(6) ARIEM in cooperation with NLABS will determine the clo value of Canadian flight mukluk.

(7) ARIEM in cooperation with NLABS will determine the clo value of a test glove, flyers, fire resistant (cold weather), currently in the hands of CDA (AK).

(8) NLABS will obtain the procurement specifications, technical/engineering data, and user requirements for the Canadian cold climate flight clothing ensemble.

(9) USAARL will conduct cockpit compatibility investigation of Canadian and US Army cold weather flight clothing.

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c. Characteristics and justification for cold climate footwear and flight gloves were prepared in draft form and are inclosed (incls 4 and 5).

d. Attendees (see inclosure 6).

3. Observations. Workshop discussion revealed:

a. That much uncertainty existed as to the kind of requirement document (ROC, LOA, LR, or Operational Capability Objective (OCO)) that was needed for flight clothing. This uncertainty was created by the fact AR 1000-1, Basic Policies for System Acquisition, is presently in draft status and an acceptable precedent has yet to be established.

b. The need for further investigation and documentation of reported inadequacies of cold climate clothing presently available for Zones V, VI, and VII.

c. The need to consider alternatives to the present approach of providing aircrewmembers protection from the cold. The present approach is to increase clothing bulk. This approach is not entirely satisfactory because of limited cockpit space which limits protection to approximately four clo. Bulk required to protect beyond four clo becomes too great to be practical. OV-1 and AH-1 aviators, for example, are unable to wear cold climate flight clothing while flying their aircraft. Heated clothing, especially for hand and foot wear and provision to heat the cyclic and collective controls of rotary wing aircraft should be considered.

6 Incl
as

RUSSELL D. NELSON
LTC, CE
Director, TR&A

Clo Values of Cold Climate Clothing Worn by Army Aviators*

1 piece flight suit (CWU-27)	.6 clo
Short jacket (N2)	1.9 clo
Long parka (N3B)	1.8 clo
Trousers (F1B)	1.9 clo
Quilted liner for jacket & trousers (CWU-9)	1.9 clo

NOTE: This is a nylon liner. If worn, wear underneath Nomex (CWU-27).

Waffle weave cold weather cotton drawers, shirt	.6 clo each
Boots, 8" (FWU-8 - uninsulated)	.6 clo
(FWU-3 - insulated)	1.0 clo

Clo represents the amount of thermal insulation required to keep a sitting, resting person comfortable at 70°F with an air movement of 20 feet per minute and humidity not greater than 50%.

*Obtained via phone call between MAJ Lang, USAAAVS, and Mr. Ken Troup, Life Support System Program Office (ASD/SML), Wright-Patterson AFB.

DEPARTMENT OF THE ARMY
U S ARMY RESEARCH INSTITUTE OF ENVIRONMENTAL MEDICINE
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SGRD-UE-ME

23 January 1975

US Army Agency for Aviation
Safety (USAAAVS)
ATTN: Mr. Emil Spezia
Fort Rucker, Alabama

Dear Mr. Spezia:

In accordance with your request of 26 NOV 74, insulating values for the complete Canadian Aircrew Winter Uniform (as worn inside the aircraft), and for this ensemble without the intermediate flying suit, have been measured on a copper manikin in the Military Ergonomics Lab, under our study, ME-E9-75. Measurements were made with an air movement of 0.3 meters/sec using standard procedures for the copper manikin.

Insulating values, including that of the air layer at clothing surface (approximately 0.6 clo) were as follows:

a. Complete ensemble, collar of winter flying suit turned up, and hood covering flying helmet - 3.50 clo.

b. Complete ensemble, winter flying suit hood down, collar turned up and outside helmet - 3.49 clo.

c. Ensemble without intermediate flying suit, winter flying suit hood and collar as in b. above - 3.24 clo.

Components of the complete ensemble were as given below. It will be noted that substitutions of several US Army items have been made. These were necessary, (a) where the Canadian item was not furnished or (b) where it could not be fitted to the manikin. None of these substitutions should have any important effect on overall insulation value.

Components of complete ensemble tested

Underwear, winter, 50% wool/50% cotton (U.S. items)
Turtle neck sweater
Intermediate flying suit (coverall)
Winter flying suit
Socks, wool, cushion sole (U.S. item)
Boots, cold-dry, insulated, vapor barrier type (U.S. item)
Mittens, dry-cold, wool (U.S. item in lieu of leather gloves/liners)
Helmet, flying, APH-5, visor up (U.S. item)

SGRD-UE-ME 23 January 1975
Mr. Spezia

For purposes of assessing these protective merits of the Canadian ensemble, the following insulation values obtained under comparable conditions are provided:

a. Complete U.S. Army Arctic Uniform - 4.3 clo

b. Standard U.S. Army Cold-Wet Uniform - 3.2 clo

Sincerely,

Ralph F. Goldman

RALPH F. GOLDMAN, Ph.D.
Director, Military Ergonomics Laboratory

Cost and Stock Numbers of the Canadian Flight Clothing*

Jacket, flying, men's type 4

Jacket - AA 8415-21-859-0484
Trousers - 8415-21-859-0472
} $80.00

Flying overboot, rubber - 8430-21-800-2251 - $10.00 pr

Service boot or shoe, safety - 8430-21-868-7447 - $18.00 pr

Flying Mukluk, outer - 8430-21-104-6909
Wool sock AA 8440-21-103-7669
} $28.00

Felt insole - AA 8335-21-104-7179 - $.73

Plastic insole - AA 8335-21-104-7163 - $2.70 pr

Shelf life - leather - 5-10 years

rubber - 5 years

*Obtained 11 Dec 74 via phone call between Mr. William Brown, USAAAVS, and Mr. George Hodges, International Defence Programs Branch, Department of Industry, Trade and Commerce, Ottawa, Autovon 827-8011.

FOOTWEAR

(COLD CLIMATE)

JUSTIFICATION:

1. Present standard U.S. Army Vapor Barrier (VB) boot is not acceptable for wear when flying because:

a. It is too wide to permit proper pedal operation in the following aircraft: OH-6A, UH-1 series, OH-58A and OV-1.

b. It is too bulky and cumbersome to permit proper perception of abnormal aircraft vibration through the pedals.

2. The present standard VB boot is not acceptable for pre- and post-flight inspection because the overall size is too large to permit the foot to be inserted into recessed aircraft steps, e.g., climbing to inspect rotor head.

3. The currently authorized replacement for the Army standard VB boot is the USAF cold-weather mukluk ensemble. This ensemble, as it is presently being issued, has the following deficiencies:

a. The outer layer is not water resistant in accordance with specifications. As a result, water from melted snow penetrates the outer layer and destroys the insulation of the inner layers.

b. From normal flexing, shortly after issue, the USAF mukluk outer layer cracks at the base of the toes. This provides an opening for snow, slush, and water and results in wetting of inner insulating layers.

4. It would be desirable to have cold-weather footwear for flying which, in addition to overcoming the above deficiencies, would:

a. Provide greater insulation than the currently authorized USAF mukluk when aircraft are operated with cockpit temperatures below the design standard of +40°F. Cockpit temperatures are not maintainable under combat scenarios at the design standard of 40°F.

b. Provide less water retention from perspiration in the insulating layers than does the current USAF mukluk.

PRINCIPAL CHARACTERISTICS:

1. Sized to permit access into recessed aircraft steps to enable pre- and post-flight inspections.

2. Sized and configured to permit proper operations of Army aircraft foot controls. Enable detection of abnormal aircraft vibrations.

3. Constructed to provide insulation value at least as great as the U.S. Army standard VB boot (1.69 clo).

4. Must have a minimum five year shelf life.

5. Must be durable and remain flexible during normal operations in climatic categories V, VI, VII for a period of 240 days after five years shelf life.

6. Must be water resistant.

7. Must fit the current 5th through 95th percentile aviator's foot (length and ball girth).

8. Must weigh no more than 2.98 pounds per foot in size eleven.

FLIGHT GLOVES

JUSTIFICATION:

1. The present standard Nomex flight gloves do not provide sufficient warmth characteristics required for combat flight operations in climatic categories V, VI, VII.

2. It would be desirable to have cold climate flight gloves which would provide greater insulation than the currently authorized Nomex flight gloves when aircraft are operated with cockpit temperatures below the design standard of +40°F. Cockpit temperatures are not maintainable under combat scenarios at the design standard of 40°F.

PRINCIPAL CHARACTERISTICS:

1. Insulation values should be as great as possible consonant with adequate hand and finger sensitivity and dexterity for proper operation of fixed and rotary wing aircraft controls, and not less than that provided by the test sample, glove, flyers, fire resistant (cold weather), currently in the hands of CDA (AK).

2. The gloves shall be of the four finger and thumb gauntlet style of sufficient length to protect the wrist and lower forearm.

3. The gloves shall provide finger-tip sensitivity no less than that provided by the standard Nomex flight gloves.

4. The gloves shall provide a close fit on the palm, thumb and the entire finger.

5. The gloves shall be provided in adequate sizes to fit the 5th to 95th percentile values for Army aviation crewmember's fingers and thumb length and girth.

6. The gloves shall be fire retardant to a degree which will provide for protection from high intensity flash or flame equal to or better than the standard Nomex flight gloves. This degree of protection must last for the life of the garment.

7. The gloves shall be compatible in color and appearance to the standard fire resistant flight uniform - Hot Weather.

8. The gloves shall have a storage life of at least three years.

9. The gloves shall be capable of being laundered by the individual under field conditions without impairing functional characteristics.

10. The gloves shall be made of a material which contains no elements which will cause dermatitis or complications to wounds or burns. Material which contacts the wearer's skin shall not cause irritation of the skin.

ATTENDEES

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